



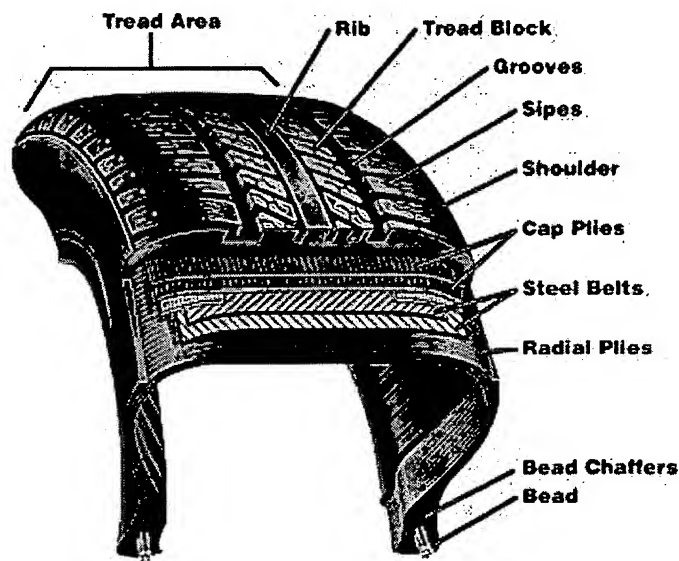
Low Cost Tire

The Smart Way To Buy Tires

Tire Construction

To the casual observer all tires look the same. But if you look carefully, you'll find modern tire construction offers a degree of handling, ride comfort, traction, treadwear and fuel economy that far exceeds tires built just a few years ago.

Today there are tire designs that contain up to 200 raw materials as well as a complex architecture of steel belts, textile plies and computer designed tread patterns. Tire manufacturers strive to deliver the most competitive designs in terms of performance and wear.



In 1946 the tire industry was revolutionized by the introduction of the radial tire. A cross section of the radial design is shown above. Today, virtually all tires sold are radials due to their benefits of superior handling, ride quality and wear.

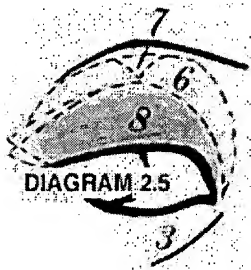
The benefits of radial construction are attributed to the design of the tire's casing - the part of the tire underneath the tread that forms the foundation of the tire. The casing is made up of a series of cords (most typically polyester) which are combined to form layers or plies. In a radial tire, these plies are positioned so the cords run alongside each other in a series of circular bands across the tread of the tire. Radial construction allows the tire to better flex and absorb the irregularities of the road surface. The radial design also produces much less friction resulting in much longer tread life.

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The top layer of the radial casing usually consists of steel belts made up of woven strands of steel cord. Steel belts provide a stable foundation for better tread wear and traction, and also protect the casing against impacts and punctures. Other components may include bead chaffers and cap plies - usually built into performance tires to enhance cornering and stability at high speeds.

The outermost part of the tire, the tread, usually attracts the most attention. The material used is referred to as tread compound, which varies from one tire design to the next. A winter tire, for example, has a compound that provides maximum traction in cold weather. Competition tires, at the other extreme, use a compound designed for very high temperature ranges. The great majority of tires are built with an all season compound that delivers traction in the broad middle range of every day driving conditions. In addition, this compound must deliver good wear; this dual goal of traction and wear remains one of the most challenging design parameters for tire manufacturers.

While tread designs vary tremendously, the elements of the tread are consistent in their use. The tread block provides traction at its leading and trailing edge. Within the block, sipes are often molded or cut to provide additional traction. Grooves are built into tread designs for channeling away water. Shoulder designs provide protection as well as additional traction during hard cornering.



TIRE CONSTRUCTION AND NOMENCLATURE

Auto Mechanics Fundamentals, 1974, Martin W. Stockel. The Goodheart-Willcos Company, Inc., South Holland, Illinois.

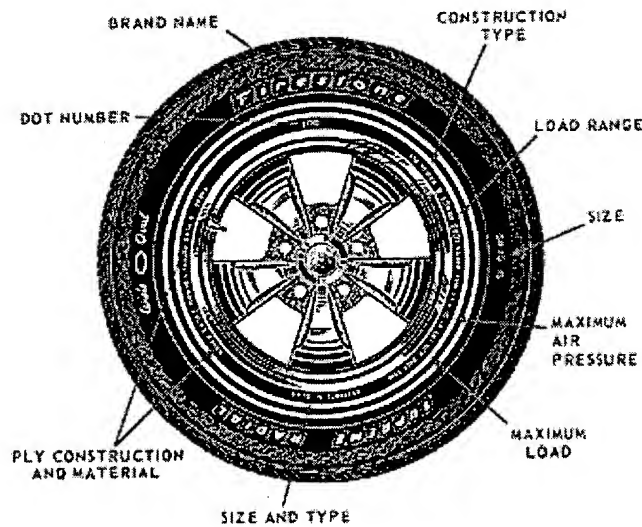


Fig. 16-14. All tires must be marked showing maximum load carrying capacity and pressure, size, load range, ply construction and material identification, manufacturer's number and construction type. (Firestone)

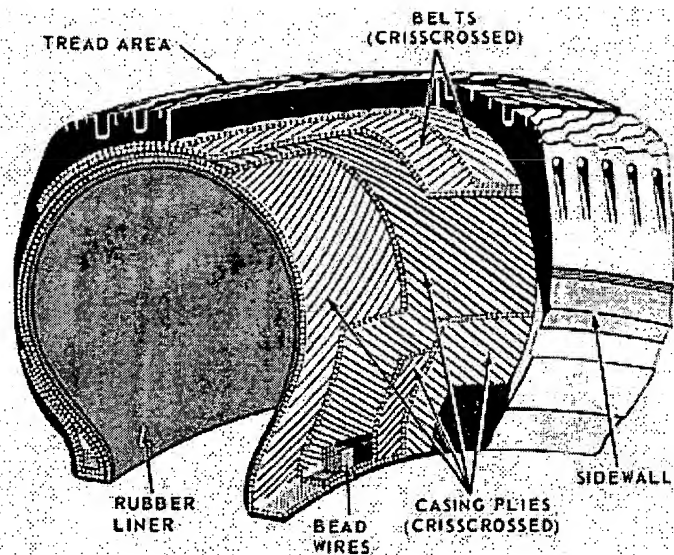
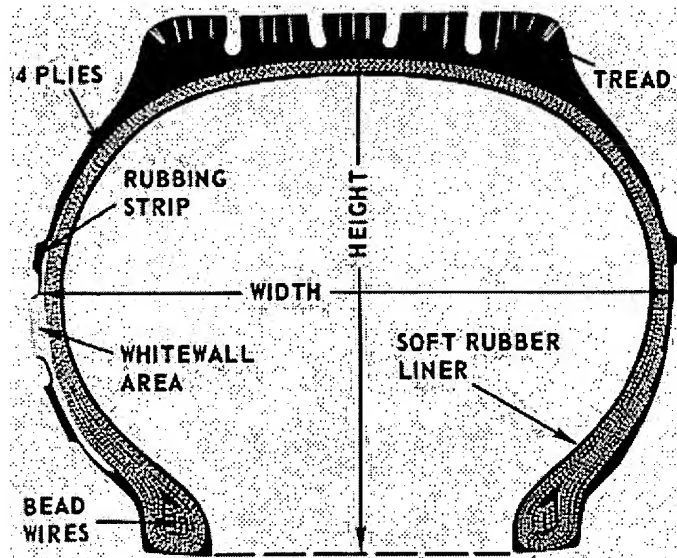
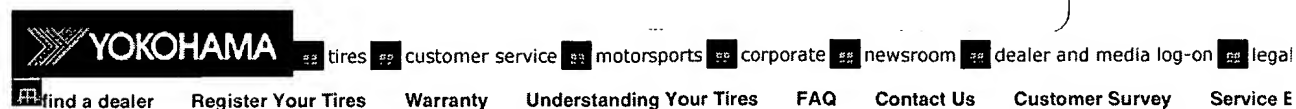


Fig. 16-11. Typical belted tire construction. This specific tire uses four sidewall plies (bias arrangement) and two belts beneath tread. (Goodrich)

Fig. 16-15. Tubeless tire



construction. Soft rubber liner prevents air leaks into plies. This particular tire is a four-ply/four-ply rating. Note width in relation to height, indicating a very low profile design.



Tire Care
Reading Your Tire
Construction
>Tread
Customizing
Glossary

TREAD

Tread Components

Tread Design

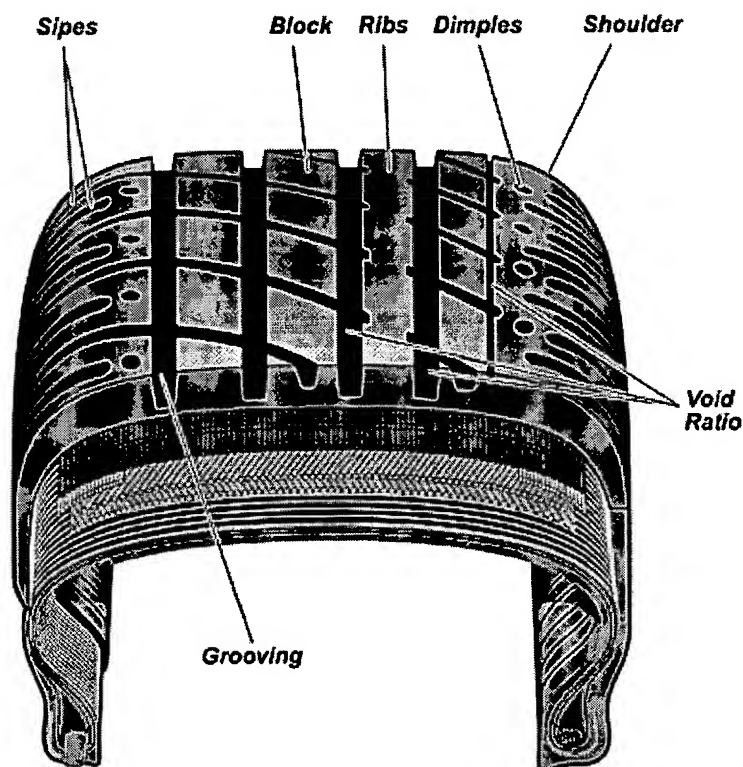
The tread is the part of the tire that contacts the pavement. The correct choice of tread design for a specific application can mean the difference between a satisfied or dissatisfied customer.

A proper tread design:

- Improves Traction
- Improves Handling
- Increases Durability

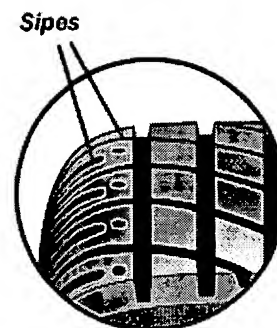
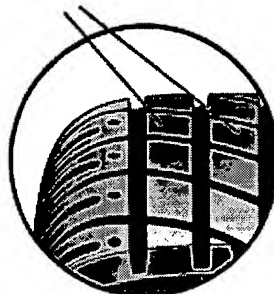
Tread design also affects other customer concerns such as:

- Ride Comfort
- Noise Level
- Fuel Efficiency



Sipes

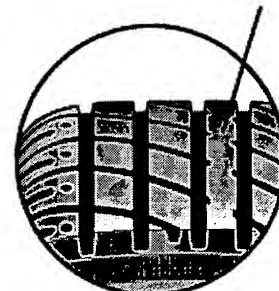
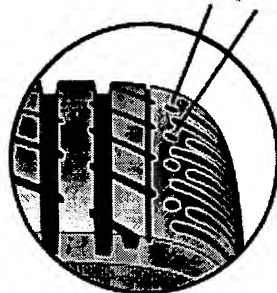
Small, slit-like grooves in tread blocks that allow the blocks to move more. This added flexibility increases traction by creating an additional biting edge. Sipes are especially helpful on ice, light snow and loose dirt.

**Blocks****Blocks**

Those segments making up a tire's tread. The primary function of tread blocks is to provide traction.

Ribs

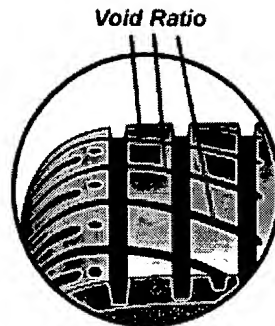
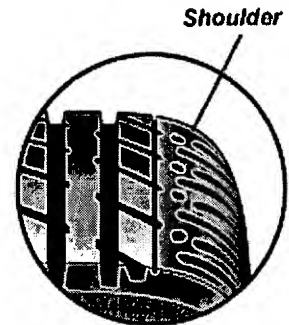
The straight-lined row of blocks that create a circumferential contact "band."

Ribs**Dimples****Dimples**

Indentations in the tread that improve cooling.

Shoulder

Provides continuous contact with the road while maneuvering. Shoulders wrap slightly over the inner and outer sidewall of a tire.

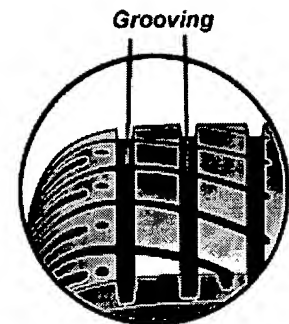


Void Ratio

The amount of open space in the tread. A low ratio means more rubber is in contact with the road. A high void ratio increases the ability to drain water. Whether a tire has a high or low void ratio depends on the tire's intended use.

Grooving

Used to create voids for better water channeling on wet road surfaces. It is the most efficient means of channeling water from in front to behind the tire. By designing grooves circumferentially, water has less distance to be channeled. Circumferential grooves provide the shortest distance from the front to the rear edges of the contact patch.



Tire Life

There are many factors to consider when researching and developing a tread design—steering response, cornering power, traction, stability, noise and treadwear are but a few. The aesthetics of the tread design are also a big factor. Many customers base much of their purchase decision on tread appearance.



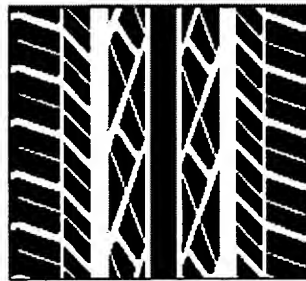
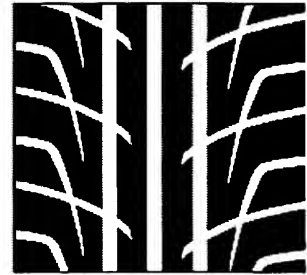
Asymmetrical Tread Pattern

The tread pattern changes across the face of the tire. Usually incorporates larger tread blocks on the outer portion for increased stability during cornering. The smaller inner blocks aid in dissipating water.

Unidirectional tread pattern

Designed to rotate in only one direction, unidirectional tires enhance straight-line acceleration by reducing rolling resistance. They also provide shorter stopping distances.

distance. Unidirectional tires must be dedicated to a specific side of the vehicle. Care must be taken when rotating unidirectional tires to ensure that the repositioned tire rotates in the correct direction.



Symmetrical tread pattern

Consistent across the tire's face. Both halves of the treadface are the same design.

Tread Design and Wet Road Conditions

Both block and rib tread patterns are used in street-tire design. Grooves are used to create voids within the tread face for better water channeling on wet road surfaces. The most efficient means of channeling water is circumferentially around the tire. It is the shortest distance between the front and rear edge of the contact patch. However, lateral grooves help break up the wedge of water that forms at higher speeds. This reduces the chance of hydroplaning and increases the tire's contact with the road.

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Glossary of Tire Terms

Alignment

The checking and adjustment of caster, camber and toe angles in a vehicle's suspension to maintain specifications engineered by the vehicle manufacturer for optimum performance.

Aspect ratio

The relationship between the section height and section width of a tire expressed as a percentage of section width. If the section height is one half the section width, the aspect ratio is 50%.

Balance

The equal distribution of the mass of the tire and wheel assembly for smooth driving. Balance is achieved by fitting weights to the wheel rim to offset uneven weight distribution of the tire or wheel.

Bead

An inextensible hoop of high tensile steel wires which anchors the plies and conforms to the rim seat to hold the tire onto the wheel rim.

Bead seat

The inner ledge portion of the wheel rim where the tire bead rests adjacent to the flange.

Belts

The plies of tire cords beneath the tread that determines the tire's diameter and stabilizes the tread by resisting deformation from cornering, braking, and centrifugal forces.

Bias-ply

A type of tire construction utilizing plies that run diagonally from one bead to the other. One ply is set on a bias in one direction, and succeeding plies are set alternately in opposing directions crossing each other. Sometimes called a cross-ply tire.

Camber

The angle between the centerline of the tire and a vertical line as viewed from the front.

Camber thrust

A cornering force generated by the tire's camber.

Casing

The tire body, composed of plies which form the tire's structure and give it shape. Sometimes called the carcass.

Caster

The angle between the vehicle's steering axis and a vertical line, as viewed from the side.

Compounding

The combining of five basic ingredients: rubber, carbon black, plasticizers, curing materials, and ozone retardants to form the tread and other "rubber" components of a tire.

Contact patch

(See **Footprint**)

Cornering force

The lateral frictional force generated by a cornering tire, acting in opposition to the centrifugal force.

Crown

The center area of a tire's tread.

Deflection

The difference between a tire's unloaded or free radius and the loaded radius.

Directional stability

The tendency for a tire to roll in its steered direction rather than follow road contours.

Footprint

The area of the tire's tread that is in actual contact with the ground. (See **Contact Patch**)

Harmonic marking

Markings on wheels and tires that allow match mounting to cancel tire and wheel runout, minimizing vibration.

Hoop strength

The retention strength inherent in the belt construction of a tire that resists centrifugal force and provides dimensional stability.

Hydroplaning

The accumulation of water in a film under the footprint which causes a tire to lift from the road surface, losing traction. Hydroplaning is affected by vehicle speed, tread pattern, and water depth.

Imbalance

The condition that exists when a tire's mass is not evenly distributed around the rolling axis and centerline, causing

- bounce (static imbalance) or shake (dynamic imbalance).
- Inflation pressure**
The pressure of air inside a tire which applies a tensile stress to the tire cords permitting them to carry the vehicle's load.
- Liner or inner-liner**
The thin layer of halobutyl rubber inside a tire that contains the inflation air, sometimes called the inner-liner. All Dunlop passenger tires are manufactured with an inner-liner.
- Mixing tires**
Fitting tires of different sizes or constructions to a vehicle. Mixing should be avoided. Some performance vehicles, however, specify different size tires on front and rear axles.
- Mounting tires**
The act of fitting tires to wheel rims.
- Overall diameter**
The diameter of an unloaded, inflated tire measured from the crown on one side to the crown on the opposite side. The free radius equals one-half the overall diameter. Sometimes called the outside diameter.
- Overinflation**
The condition that exists when a tire is inflated beyond the pressure corresponding to the actual load or beyond the vehicle manufacturer's recommendation .
- Oversteer**
The situation that occurs in cornering when the rear of a vehicle tends to skid before the front.
- Plies**
The reinforcing members of a tire composed of layers of cord fabric and rubber that provide the strength to contain the air pressure needed to support a load and resist deflection.
- Radial**
The tire construction utilizing plies that run radially from bead to bead under the tread. This construction requires a belt to stabilize the tread and define the tire diameter.
- Revolutions per mile**
The measured number of revolutions made by a tire traveling one mile.
- Rim**
The portion of a wheel incorporating the well, seats, and flange onto which a tire is mounted.
- Rim diameter**
The diameter of the rim bead seats that support a tire, normally indicated in whole numbers in inches for passenger cars.
- Rollover**
The condition that occurs during hard cornering when a tire sidewall rubs the road surface.
- Rotation**
The systematic movement of tires from one vehicle position to another to maximize tread life and minimize irregular wear.
- Runout**
The measure of the out of roundness of the tire causing a vibration which cannot be balanced.
- Rim width**
The distance between rim flanges.
- Section**
A slice of a tire from one bead, through the tread to the other bead.
- Section height**
The vertical distance from the bead edge to center of the crown in an unloaded tire.
- Section width**
The distance between a tire's sidewalls measured at the widest part of the tire. Each size of tire is measured on a specific rim width.
- Series**
A designation of a tire's aspect ratio. A tire with an aspect ratio of 60% is a 60 series tire.
- Shoulder**
The edge of a tire's tread where it joins the sidewall.
- Sidewall**
The portion of the tire between the bead and the tread. It is flexible to soak up bumps yet stiff to limit tire rollover.
- Slip angle**
The angle between the direction in which a tire is aimed or steered and the actual direction of tire travel.
- Speed rating**
A letter designation identifying the tire's high speed durability on an indoor test wheel. Refer to ECE 30 European Indoor Wheel Test Standards.
- Toe**

The difference between the front and rear edges of tires mounted on an axle. Toe-in means the front edges are closer together than the rear edges and tires point inward. Toe-out means the front edges are farther apart than the rear edges and the tires point outward.

Tread

The region of a tire designed to contact the ground. It is molded of tough rubber for high traction and low wear.

Tread pattern

The arrangement of blocks, grooves, sipes, and channels designed into the tread to enhance its grip. Also called the tread design.

Tread void

Areas in the tread, such as grooves and channels, that permit water to drain away from the footprint.

Treadwear

The measure of the life of a tire tread.

Tubeless

A tire construction which uses a rubber innerliner inside the casing to prevent air leakage and eliminate the need for an inner-tube.

Underinflation

The condition that exists when there is not sufficient air pressure in a tire to support a specific load. This causes the tire to operate with excessive deflection and rollover.

Understeer

The condition that exists during cornering when the front of a vehicle tends to skid before the rear.

Wheel alignment

See [Alignment](#).

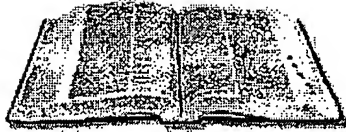
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Tire Terminology



Alignment

The mechanical condition of adjustable components within the vehicle's suspension. When a vehicle is in alignment, the caster, camber, toe-in and thrust settings are set to specification. Severe impacts (hitting potholes or curbs) and worn suspension parts are the leading causes of misalignment.

All Season Tires

Tires designed to provide good traction in a wide variety of road conditions, including wet, dry and mud and snow. This design also limits the tire's performance in extreme conditions, or when compared to tires built for a particular category.

Alphanumeric

A term for describing the size of a tire (H78-15, for example) where both letter and numbers are used.

Aspect Ratio

A term that describes a tire's height-to-width proportion. If a tire's sidewall height were 65% of its section width, its aspect ratio would be 65. In the tire size expressed as 205/65-15, the number 65 is the aspect ratio.



Balance

The state in which a tire and wheel assembly spins with all its weight distributed equally. A wheel balancer is used to place weights compensating for static and dynamic imbalances that exist in all assemblies. Not balancing an assembly will result in extreme vibration.

Bead

A round hoop of steel wires, wrapped or reinforced by steel cords, placed at the very inside of the tire's diameter.

Bias Ply Tire

A pneumatic tire manufactured such that the plies are laid at alternate angles less than 90 degrees to the centerline of the tread.

These criss-cross plies give the tire its strength, but generate heat during operation and limit the tire's wear and performance.



Carcass

The tire body beneath the tread and sidewalls; also called the casing.



Cord

The strands of material forming the plies or layers of tire. Cords may be made fiberglass, rayon, nylon, polyester or steel.

DOT Markings

A code molded into the sidewall of a tire signifying that the tire complies with the Department of Transportation motor vehicle safety standards. The DOT code includes an alphanumeric designator that also identifies the tire's manufacturer, production plant and date of production.

Footprint

The portion of the tread that contacts the road during operation.

Friction

The resistance of one material (the tire tread) as it moves against another (the road); this is the force that causes the tire to grip to the road.

Groove

The space between two adjacent tread ribs; also called tread grooves.

**Highway Tires**

Also called summer tires; designed for dry and occasional wet weather driving, but not for use on snow and ice.

Hydroplaning

A skimming effect caused by tires losing contact with a surface covered by water.

Innerliner

The innermost layer of a tubeless tire which prevents air from permeating through the tire. This thin layer of material replaces the inner tube.

Load Index

An assigned number ranging from 0 to 279 that corresponds to the load carrying capacity of the tire.

Maximum Inflation Pressure

The maximum air pressure to which a cold tire may be inflated; found molded on the tire's sidewall.

Overall Diameter

The diameter of an inflated tire without any load.

Overall Width

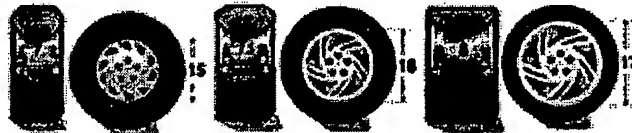
The distance between a tire's outside sidewalls, including lettering and designs.

P Metric

Uniform designation of tire sizes in metric measurements originally introduced by American tire manufacturers in 1977. Commonly called "P-metric series." A typical P-metric tire size is P215/70R-15.

Plus Sizing

An option allowing drivers to customize the appearance and performance of the vehicle by mounting lower profile tires on larger diameter wheels. One-inch greater diameter is referred to as plus-one, two inches is plus-two... and so on. Using a lower profile tire with a greater diameter rim allows the overall diameter to remain constant.

**Ply**

A rubber-coated layer of fabric containing cords that run parallel to each other and extends from bead to bead and goes between the innerliner and belts of tread.

Ply Rating

A method of expressing load carrying capacity in terms of plies. A 6-ply rating is now expressed as Load Range C; however, the tire is not built with six individual plies. Instead, it contains one or two plies of equivalent strength. The result is a cooler running, longer lasting tire.

**Radial Ply**

Tire construction where the cords in the body run at 90 degrees to the centerline of the tread.

Rim Width

Distance between the two opposite inside edges of the rim flanges.

**Rolling Resistance**

The force required to keep a tire moving at a constant speed. The lower the rolling resistance, the less energy needed to keep a tire moving.

Rotation

Moving tires from side to side or front to rear on a vehicle in a prescribed pattern to achieve uniform wear on all tires. Rotations should be performed regularly every 6,000 miles.

Section Height

The height of a tire measured from the rim to the outer tread.

**Section Width**

The distance between outside side-walls, not including any lettering or design.

Series

A numerical representation of a tire's aspect ratio. For example, 60 Series indicates a tire with a 60% aspect ratio.

the tire's section height is 60% of its section width (See Aspect Ratio).

Shimmy

Wobbling of wheels from side to side on a vehicle. Improperly balanced tires, misalignment and bent wheels can cause shimmying.

Shoulder

The part of a tire where the sidewall and tread meet. Certain tire design features shoulder blocks for better traction.

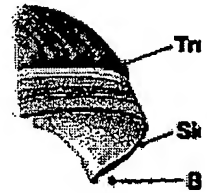


Sidewall

The part of the tire between the tread and the bead.

Size

An expression that defines a particular tire in terms of its width, height, rim diameter, aspect ratio and construction type. 205/65R-15 expresses tire size using the metric system. For more detail information, visit our page on [reading the tire size](#).



Snow Tire

Also referred to as a winter tire; a special type of tire with a tread and compound that gives better traction in snow. Identified by M&S, M+S or M/S on the sidewall. All season tires also include these designations on the sidewall.

Traction

The friction between a tire and the road surface; the amount of grip provided.

Tread

The part of the tire that comes into contact with the road. The tread type is distinguished by the design of its ribs and grooves.

Treadwear Indicator

Narrow bands, sometimes called "wear bars", that appear across the tread when 2/32" of tread remains.



Tread Width

The width of a tire's tread.

UTQG

Uniform Tire Quality Grading standards. A tire information system that provides consumers with ratings (from AA to C) for a tire's traction and temperature. Treadwear is numeric rating. Ratings are determined by tire manufacturers using government-prescribed test procedures, and are molded into the tire's sidewall. [Treadwear, traction and temperature](#) page explains this rating system in much more detail.

Valve

A device mounted in the wheel that lets air in or out of the tire. Valves include

to keep out dirt and moisture and a valve to prevent air from escaping.

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